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(54) Processing photographic material

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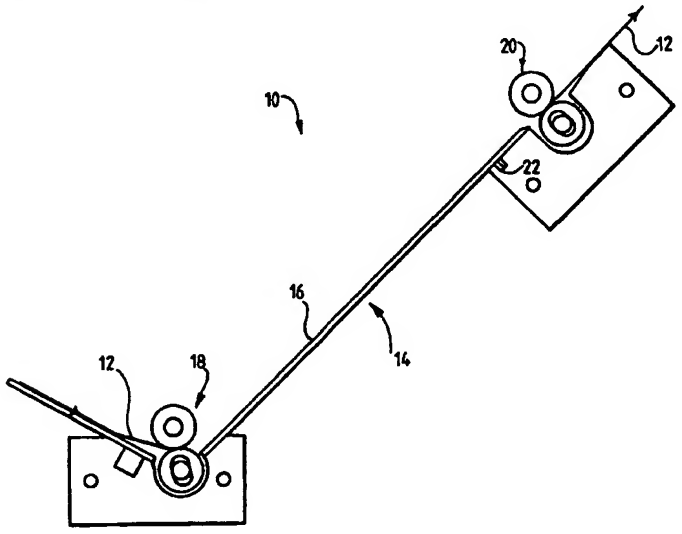

Fig.1.

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Description

Field of the Invention

[0001] This invention relates to the processing, and particularly but not exclusively the washing or stabilising, of photographic material, usually already exposed, in which the material passes through a plurality of stages, preferably in a counter-current mode.

Background of the Invention

[0002] Photographic material as referred to herein is understood to be generally planar, may comprise film or paper, may produce a black-and-white or colour image, and may be in a continuous web form or may comprise discrete sheets.

[0003] Silver halide photographic materials are well-known, and are processed to generate a silver or dye image via a development stage followed by a series of baths to stabilise and provide permanence to the image. Such baths convert and remove unwanted materials from the coated photographic layers which would either interfere with the quality of the final image or cause degradation of the image with time. In typical colour systems the development stage is followed by a bleach stage to oxidise the developed silver to a form which can be dissolved by a fixing agent in the same or a separate bath. Such silver removal stages are then followed by a washing stage using water, or other wash solution, or a stabilisation stage using a stabiliser solution. For convenience, this last-mentioned stage will hereinafter be referred to generically as "washing". Such stages remove residual chemicals and may also include conversion reactions between stabiliser solution components and materials within the coated layers. These stages are required to provide the required degree of permanence to the final image.

[0004] In many cases, particularly in small-scale "minilab" or "microlab" equipment, the wash stage is performed in a multi-tank arrangement. Usually the replenishment of this stage, which keeps the concentration of substances removed from the photographic material at a constant and sufficiently low level, is carried out by adding fresh wash solution to the final tank of the sequence and arranging over-flow from the final tank to flow into the previous tank and so on, the over-flow from the first tank of this stage being then discarded as effluent. This is referred to as a "counter-current "mode. This arrangement allows significantly lower amounts of solution to be used compared with one or two tanks especially when these are replenished separately.

[0005] In all of these arrangements, processing is carried out with the photographic material immersed in a tank of solution, even though many, though not all, photographic materials are sensitised with an emulsion only on one side thereof.

[0006] Furthermore, in a modern minilab a typical wash replenishment system might use around 200 cm^3 of replenisher per m^2 of sensitised material processed in a three or four-tank counter-current arrangement. The time the processed material spends in each tank is typically 20 to 25 seconds during which time an equilibrium is established between the concentration of substances in the coated material and the seasoned (steady-state) concentrations in the wash solution. The total time for this stage typically varies from 60 to over 100 seconds.

[0007] US-A-5 365 300 discloses a process for the treatment of photographic material with a bath containing at least one processing material, in which, after the treatment bath, the photographic material is guided upwards through an ideally preferably vertical compartment which closely surrounds the material which is washed from above by water flowing under gravity in counter-current to the material. The wash water is arranged to carry chemicals off the material into the bath for re-cycling.

Problem to be Solved by the Invention

[0008] It is desirable to process photographic material more rapidly, and in particular to reduce overall wash times by several factors, for example to about 20 seconds as compared to 100 seconds, whilst reducing overall replenishment rates. Reduction of the path-length of the wash section of the process, for example, will shorten the time taken, for a given transportation speed of the material being processed. This latter parameter is usually constrained by the demands of the previous tanks. Unfortunately, simply reducing the number of counter-current tanks involved, while achieving the goal of shorter path-length, would require a significantly increased replenishment rate to achieve the same seasoned concentration (steady-state concentration) in the final tank from which the sensitised material emerges before being introduced to the drying stage.

[0009] It is also desirable to minimise the effluent from the processing. This is advantageous not only for the protection of the environment, but also to the operator, especially of mini- and micro-labs, in terms of having less solution for disposal.

Summary of the Invention

[0010] In accordance with one aspect of the present invention, there is provided apparatus for processing photographic material, comprising a ramp that defines a surface inclined to the horizontal, first and second guide means spaced apart along the length of the ramp for guiding the material along the inclined surface, means for supplying processing solution to the ramp such that it flows along said surface, wherein the material is arranged to move along the ramp such that the solution is forced between the inclined surface and the adjacent

side of the material, thereby to effect the processing.

[0011] The angle of inclination of the surface to the horizontal is preferably between about 10° and 80°, more preferably between about 30° and 50°, and most preferably is between about 40° and 45°.

[0012] Advantageously, each guide means comprises a set of rollers through which the material is arranged to pass, and the first set of rollers may be located substantially at the lower end of the ramp and the second set of rollers may then be located substantially at the upper end of the ramp.

[0013] Preferably the processing solution is applied to the upper end of the ramp and allowed to flow down under gravity, with the photographic material being driven up over the surface.

[0014] In accordance with a further aspect of the present invention, there is provided a method of processing photographic material, wherein the material is passed through first guide means and urged towards an inclined planar surface of a ramp and is subsequently urged away from the surface through second guide means, the second guide means being spaced from the first guide means along the ramp, and wherein processing solution is supplied to the surface beneath the material so as to effect processing thereof.

[0015] The method may be carried out on the apparatus of the invention, and may effect washing, or developing, bleaching, or fixing of the photographic material.

Advantageous Effect of the Invention

[0016] A particularly simple processing arrangement is thus provided, which facilitates, for example, counter-current washing in a photographic processor. The length of the ramp surface can be arranged to be sufficient to effect total processing of the material. For example, washing can take place for a time such that at the top of the ramp the residual concentration of chemicals in the material has reached a practical minimum value, before the material is removed to a drying stage.

[0017] Utilising a single surface for the entire stage means that no clearly identifiable discrete processing "tanks" are evident, so that the unproductive crossover time associated with passing from one traditional tank to the next is reduced to zero. When counter-current flow is arranged, there is non-homogeneity of the seasoned (steady-state) condition of the solution in the stage as a function of position within the stage. The solution is nearest to that of fresh replenisher at the top or uppermost part of the ramp, and at the bottom it is nearest to the composition of the solution carried over from the previous stage. Effectively, therefore, the invention can provide multi-stage counter-current processing with an indefinite number of stages.

[0018] The inclined surface of the ramp may be textured so as to agitate the solution in contact with the photographic material.

[0019] When small quantities of processing solution are used, evaporation can present a significant problem. With the present invention, however, this can be minimised when, as in preferred embodiments, the emulsion side of the photographic material is arranged to face the surface of the stage through which it is transported. In this way, the material itself acts as a cover to reduce evaporation of the solution.

[0020] Some processing solutions have hydrophobic properties, and to encourage a capillary action between the solution and the material to be processed, a thin cover of plastics material may initially be placed over the surface of the stage, with the photographic material subsequently being fed underneath.

[0021] Reference is made to related commonly-owned co-pending applications disclosing other aspects of photographic processing, filed contemporaneously herewith under Applicant's references 10820,10821 and 10824, the entire contents of which are incorporated herein.

Brief Description of the Drawings

[0022] Apparatus for, and methods of processing photographic material, in accordance with the present invention, will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic elevation of an embodiment of the apparatus;
Figures 2 to 5 depict various textures of surfaces used in the apparatus of Figure 1; and
Figure 6 is a schematic view of a processing apparatus.

Detailed Description of the Invention

[0023] Referring to Figure 1, the apparatus 10 is arranged to carry out washing of a continuous strip of exposed photographic film 12 after it has passed through developing, bleaching and fixing stages (or bleach/fix stage). Figure 6 shows the film 12 passing through developing fluid 70 in the developer tank 80 and then through a bleach/fix solution 90 in a bleach/fix tank 95 before it reaches the wash stage. The wash stage comprises a ramp 14 having an upper surface 16 inclined at 45° to the horizontal. The film 12 arrives from the preceding stage and is fed into the nip of a lower pair of rollers 18. The film 12 is driven, emulsion side downwards, by the rollers 18 up the inclined surface 16 and removed from the ramp 14 by means of an upper pair of rollers 20 and passed on to the drying stage (not shown). Washing solution is directed onto the ramp 14 through jets 22 that extend cross the surface 16 at its top end, such that the greater part, if not all, of the solution flows down the surface 16 beneath the ascending film 12. The speed of movement of the film 12 and the length of the inclined surface 16 are such that the film emulsion is washed for a time sufficient substantially to

achieve equilibrium of the concentration of chemicals by the time it arrives at the clean solution issuing from the jets 22 at the top of the ramp. It will be appreciated that the counter-current mode of operation means that the film 12 is cleaned as it moves up the ramp 14 and the wash solution becomes dirtier as it flows downwards.

[0024] The washing of the film 12 is enhanced by texturing of the ramp surface 16, which provides agitation in the capillary layer of processing solution pressed by the film 12 against the ramp 14. Figure 2 shows one example of this, in which part of an inclined surface is indented orthogonally. Figure 3 shows a surface with random indentations, and in Figure 4 the surface has a diamond configuration. Other texturing may be applied. In the enlarged view shown in Figure 5, slots 60 are cut in transversely-extending ribs 62 of the surface. The depth of the troughs 64 between the ribs 62, the number, frequency and width of the slots 60, and their degree of stagger in successive ribs 62, can all be selected to give the required effect on the flow of the solution in the layer beneath the photographic film 12, as well as on the flow rate of replenisher counter-current to the material.

Claims

1. Apparatus for processing photographic material, comprising a ramp that defines a surface inclined to the horizontal, first and second guide means spaced apart along the length of the ramp for guiding the material along the inclined surface, means for supplying processing solution to the ramp such that it flows along said surface, wherein the material is arranged to move along the ramp such that the solution is forced between the inclined surface and the adjacent side of the material, thereby to effect the processing.

2. Apparatus according to claim 1, wherein each guide means comprises a set of rollers through which the material is arranged to pass, and wherein the first set of rollers is located substantially at the lower end of the ramp and the second set of rollers is located substantially at the upper end of the ramp.

3. Apparatus according to claim 1 or claim 2, wherein the processing solution is supplied to one end, preferably the upper end, of the ramp.

4. Apparatus according to any one of the preceding claims, wherein the material is driven up the ramp.

5. Apparatus according to any one of the preceding claims, wherein the inclined surface of the ramp is textured so as to provide agitation of the solution.

6. Apparatus according to any one of the preceding claims, comprising a processing stage arranged to receive the material subsequent to leaving the ramp through one of the guide means, the tank containing processing solution in which the material is immersible.

7. Apparatus according to any one of the preceding claims, wherein the supply means is arranged to supply a wash solution to the ramp and/or the tank for washing photographic material.

8. A method of processing photographic material, wherein the material is passed through first guide means and urged towards an inclined planar surface of a ramp and is subsequently urged away from the surface through second guide means, the second guide means being spaced from the first guide means along the ramp, and wherein processing solution is supplied to the surface beneath the material so as to effect processing thereof.

9. A method according to claim 8, wherein the material is moved in a direction up the inclined surface.

10. A method according to claim 8 or 9, wherein the solution is arranged to flow down the inclined surface.

11. A method according to any one of claims 8 to 10, wherein subsequent to leaving the ramp, the material is immersed in processing solution in a tank.

12. A method according to any one of claims 8 to 11, wherein the processing solution effects washing of the photographic material.

13. Apparatus for processing photographic material, substantially as hereinbefore described with reference to the accompanying drawings.

14. A method of processing photographic material, substantially as hereinbefore described with reference to the accompanying drawings.

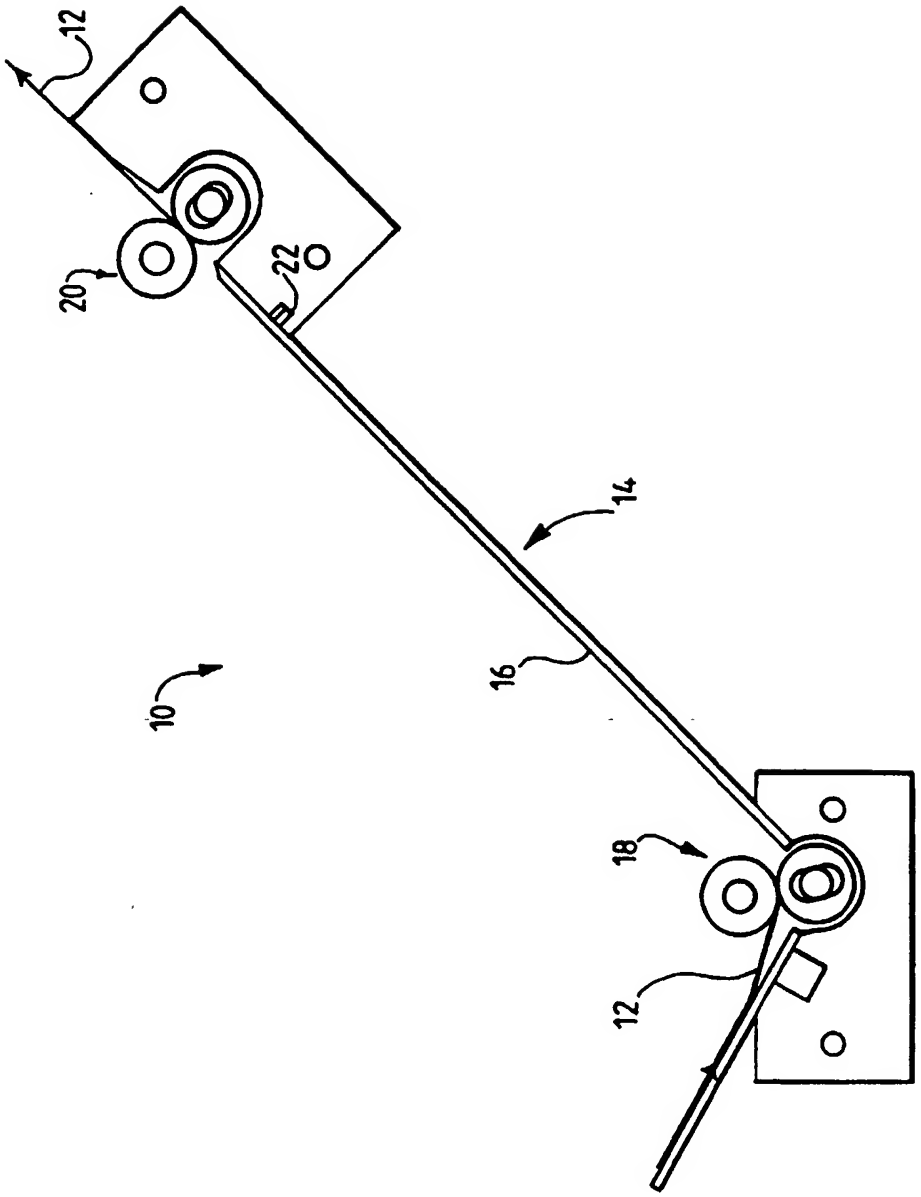


Fig.1.

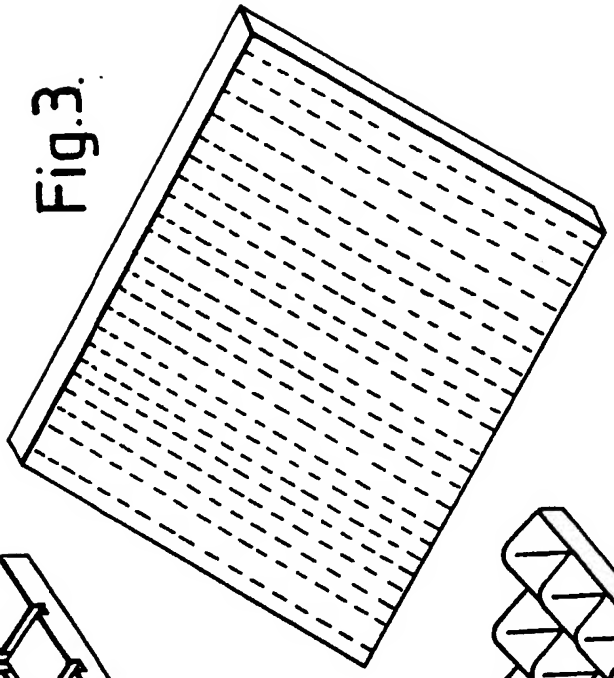


Fig.3.

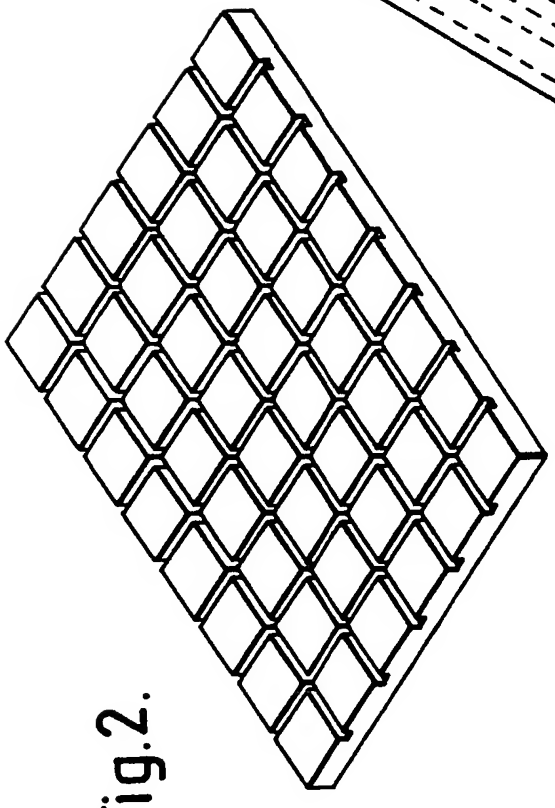


Fig.2.

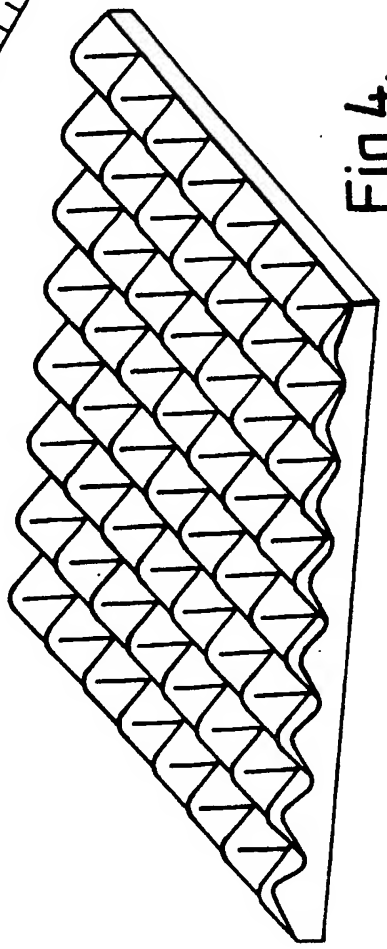


Fig.4.

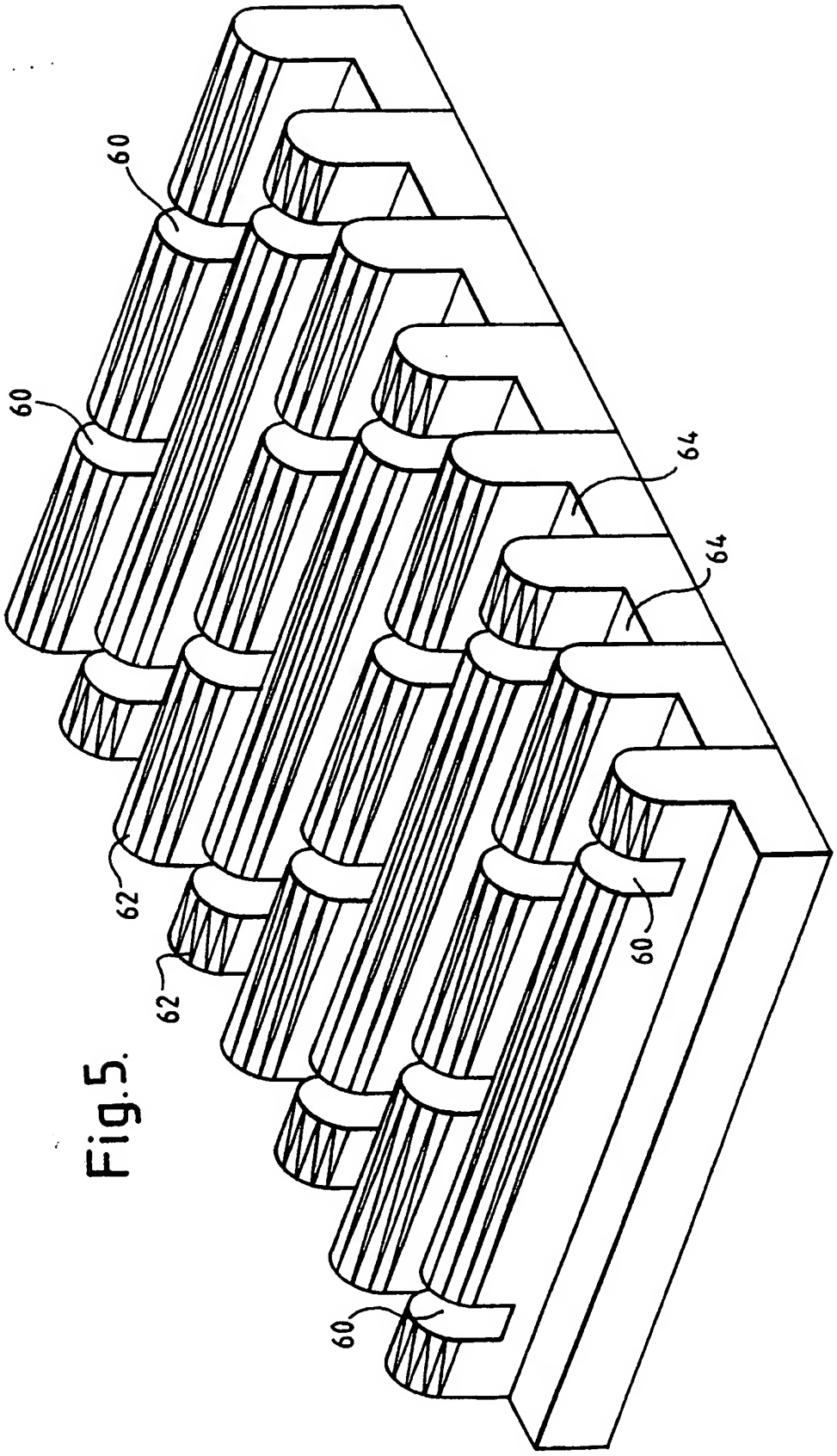
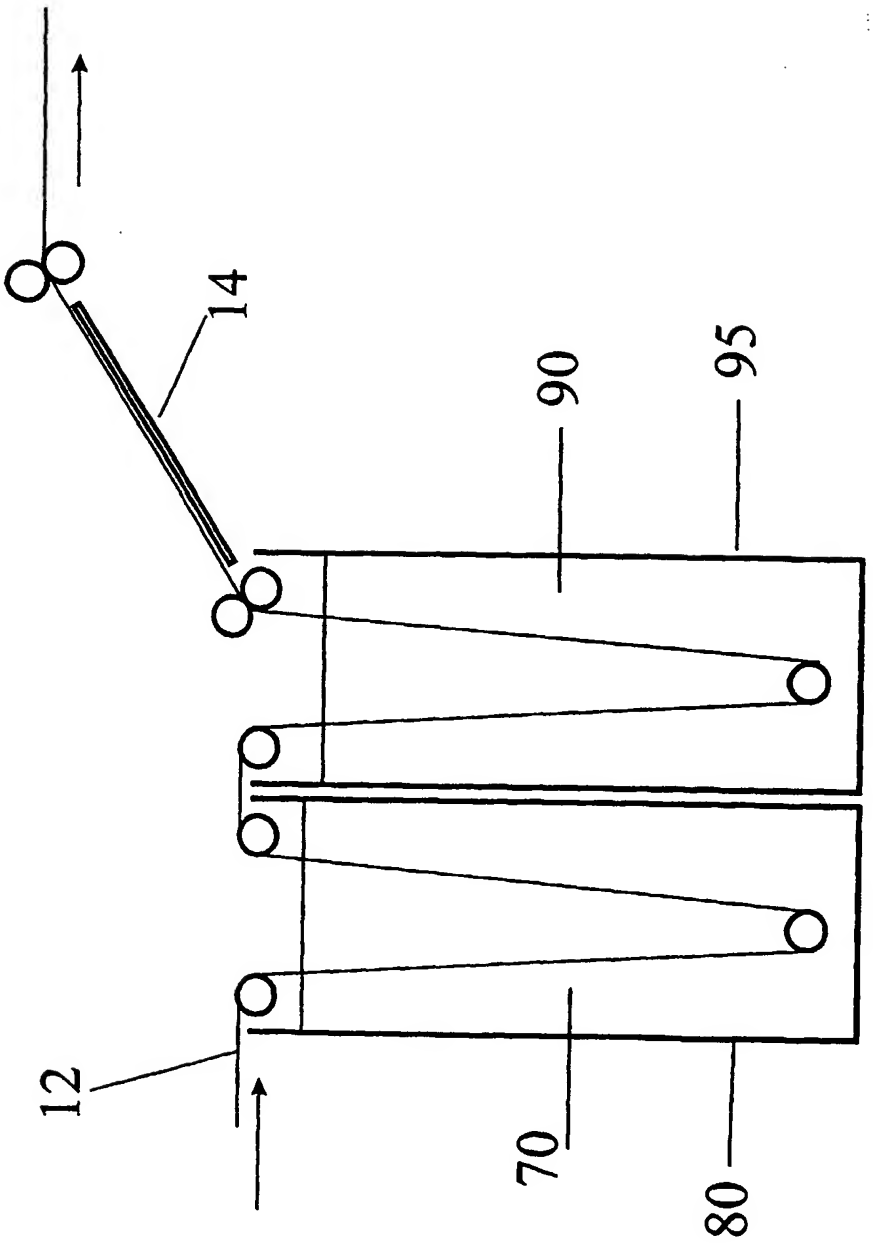


Fig.5.

Figure 6



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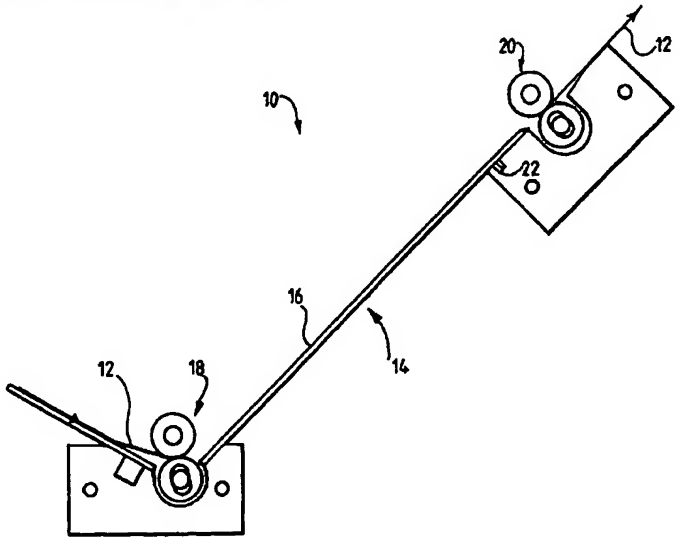

Fig.1.

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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 2933

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	GB 423 857 A (J.HALDEN & CO.LTD.) * page 1 - page 2; figure 1 *	1-3,7,8, 10,12	G03D3/13 G03D5/00
A	US 3 721 175 A (S.NEEDLEMAN) 20 March 1973 * column 3 - column 6; figures 1-11 *	1,3,7, 10,12	
A	EP 0 606 195 A (PICTURE PRODUCTIONS LTD. PARTNERSHIP) 13 July 1994 * column 5 - column 13; figures 1-12 *	1,2,7,12	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) G03D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 April 1999	Boeykens, J

CATEGORY OF CITED DOCUMENTS

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